

Wisconsin Highway Research Program

Research Problem Statement

Problem Title:

Investigation of Concrete Properties to Support Implementation of the New AASHTO Pavement Design Guide

Background and Problem Statement:

The Wisconsin Department of Transportation (WisDOT) has received a copy of the new "2002 Design Guide, Design of New and Rehabilitated Pavement Structures". The Department is now reviewing the procedure, performing sensitivity analysis and determining the effort required to adopt and implement the procedure. The new concrete pavement design procedure contains two concrete properties not previously measured by WisDOT. They are AASHTO T198 - Splitting Tensile Strength of Cylindrical Concrete Specimens and AASHTO TP 60 - Coefficient of Thermal Expansion of Hydraulic Cement Concrete. These two variables in the design process are very sensitive in determining the thickness design and predicted performance of the pavement. So, information on the relevant input variables for the procedure is required in order to assure successful implementation of this new mechanistic-empirical design procedure being proposed by AASHTO.

Scope:

It is anticipated that there are two phases to this project. The first is a research and materials collection phase. The second is a laboratory study of representative concrete mixtures for the determination of split tensile strength and coefficient of thermal expansion.

The first phase entails researching the standard testing procedures, conducting a literature search to determine work done in this area to date in other states and universities and then setting up a testing matrix of representative concrete mixes for the State of Wisconsin. It is anticipated that the following materials will be considered as part of the determination of the concrete mixes to be tested:

Portland Cement Sources

Holcim
Lafarge
CEMEX
Lonestar
St. Mary's

Slag Sources

Lafarge
Holcim

Fly Ash Sources

Portage Power Plant
Pleasant Prairie Ash
Weston Power Plant

Predominant Coarse Aggregate Types

Glacial Gravels:

Lake Michigan Lobe – Southeast WI – ???
South End of Green Bay Lobe – Janesville Sand and Gravel – Lycon
Central Green Bay Lobe – south of Stevens Point – ???
Wisconsin Valley (& Langlade) Lobe – Wausau area – ???
Chippewa River Gravel – Eau Claire – American Materials
Lake Michigan/Green Bay Transition – Manitowoc - ???

Crushed Stone:

Niagara Dolomite – Vulcan Materials – Sussex
Galena/Platteville Dolomite – Northeast WI – Ebben Quarry – Brown County
Galena Dolomite – Southwest WI – Reddy Quarry – Mineral Point
Prairie Du Chien Dolomite – Northeast WI – Faulk Bros – New London
Prairie Du Chien Dolomite – Southwest WI – Wetzel Quarry – Prairie Du Chien
Baraboo Quartzite – Williams Quarry – Baraboo
Dresser Traprock – Basalt – Northwestern WI – Dresser Quarry
Granite – South of Marshfield – Haske Quarry
Diabase – North of Wausau – RME Quarry

Researcher will develop a testing matrix in Phase 1 for the prescribed testing for the spectrum of aggregates against a cross section of representative cementitious materials. WisDOT staff will work with the researcher in final selection of aggregate sources, and will assist the researcher as needed in gaining access to the selected aggregate sources.

Phase 2 of this project will include the mixing of concrete, development of test samples and the split tensile strength testing and coefficient of thermal expansion testing, reporting the results and recommending input values to be used by the Department in the AASHTO 2002 procedure.

Specific Results, Findings, Tool, etc.

1. Recommended values for split tensile strength testing and coefficient of thermal expansion to be used by the Department in the pavement design process.
2. Development of standard practice and recommendation for future work in this area by WisDOT.
3. Incorporation of results into WisDOT guidance and policy.

Length of Research Project and Approximate Cost to Complete

A one year study is proposed with an approximate cost of \$60,000.

Urgency and Potential Benefits:

Successful completion of this project will allow for the proper input values to be used in the initial phases of development and implementation of the new AASHTO pavement design procedure. This is important because the prediction models in the procedure are extremely sensitive to the split tensile strength and coefficient of thermal expansion.

Additional Requirements for Implementation:

Review and acceptance by the Department and incorporation into pavement design policies and guidelines.

Submitted by:

Rigid Pavement TOC

Kevin McMullen, Wisconsin Concrete Pavement Association and Jim Parry,
Wisconsin Department of Transportation.